

## **C-130 IMPEX / INTEX-B Flight summary**

**date:** 5 May 2006 (20060505)

**flight number:** 8

**Take-off:** 17:30:28 GMT

**Landing:** 01:57:00 GMT

### **Objectives:**

- spiral over Trinidad Head coincident with Terra overpass
- quasi-lagrangian sampling of DC-8 observations from Thursday, 4 May
- sample aged and subsiding pollution over the eastern Pacific
- learn the models' predictive capabilities for Asian plumes

### **Instrument status:**

Overall, instruments operated well on this flight. SABL, however, was inoperable. NCAR CIMS also experienced a problem with OH due to a malfunctioning SO<sub>2</sub> flow controller, but the problem was corrected early in the flight. Power transfer had to be directly from GPU to engines due to a loss of the APU. This might have caused a problem for CO (lamp turned off) and the flight was delayed due to confusion on the part of the flight scientist regarding the NO<sub>x</sub> system which doesn't measure until after takeoff. This delayed takeoff by ~15 minutes, but the delay was ultimately not an issue. The delay also allowed time for the recovery of the CO lamp which lit only seconds after takeoff.

### **Flight summary:**

The C-130 flight was executed as planned, with the exception of the Terra spiral which was cancelled due to heavy stratus clouds (see below). Heading south toward Trinidad Head, O<sub>3</sub> variability was high, ranging from 50 to 110 ppbv, with enhanced layers around 10-15 kft and above 19kft. CO varied between 120 and 170 ppbv with the lowest and highest CO values corresponding to low ozone and mid values corresponding to high ozone periods. Other evidence of pollution was noted at 5500 ft over Oregon (O<sub>3</sub> ~70, CO 160-170, NO<sub>y</sub> 1-2 ppbv, CH<sub>2</sub>O ~700 pptv, elevated PAN, organic aerosol, etc.).

On descent toward Trinidad Head, thick marine stratus was observed ahead and the decision was made to abort the Terra spiral. The stratus extended inland which also prevented a flyby of the ground site at Trinidad Head. Instead, five-minute flight legs were executed skimming just above the clouds, within the clouds, and below the clouds to evaluate the response of solar radiation, radicals, and soluble species. The cloud deck was dense enough to enable flight periods that were fully within the cloud with no visibility above or below the aircraft. On ascent, very clean air (O<sub>3</sub> ~35, CO <100 ppbv) was encountered between 7-10 kft. Above, O<sub>3</sub> reached over 110 ppbv with CO 150-160 and NO<sub>y</sub> ~0.5 ppbv. At 22 kft, O<sub>3</sub> 70-80 ppbv was anticorrelated with CO 150-110 ppbv and NO<sub>y</sub> was low (~0.2 ppbv).

On the next descent heading toward the southwestern end of the flight, it was expected that we should start encountering the aged Asian pollution predicted by the models. At 15 kft a very thin layer of enhanced O<sub>3</sub> (~150 ppbv) was encountered, but it

did not look like pollution. Further down at ~10 kft, a layer containing CO > 200 ppbv, O<sub>3</sub> ~90, and NO<sub>y</sub> ~1 ppbv was encountered. This leg was only about 1000 ft thick and the aircraft oscillated between 9-10 kft looking for the layer, but it could not be located. Continuing down, MBL conditions were O<sub>3</sub> ~45, CO ~140, and NO<sub>y</sub> was negligible. Ascending from the MBL, the polluted layer was seen again at ~10 kft (O<sub>3</sub> ~130, CO ~200, and NO<sub>y</sub> ~0.9 ppbv) but was too thin to sample with a horizontal leg.

The next descent near the southwestern point of the flight track revealed the polluted layer to be just above the marine stratus marking the top of the MBL. The layer was very structured with CO as high as 200 ppbv, O<sub>3</sub> up to 90 ppbv, and NO<sub>y</sub> up to 0.5 ppbv. This layer was sampled several more times by ascending from the surface to 7kft, the back down into the MBL and up again.

For the remainder of the flight, the aircraft was taken to altitude (~18 kft) for 10 minutes followed by soundings to the surface and immediately back up to altitude. This allowed for an additional 6 soundings of the polluted layer. These soundings revealed an upward trend in the altitude of the polluted layer moving from west to east back toward the coast. This trend was predicted by the models and was observed for CO, O<sub>3</sub>, NO<sub>y</sub>, PAN, and aerosol scattering. In terms of CO and NO<sub>y</sub>, the pollution signal weakened with altitude, but the opposite was true for ozone. The altitude of maximum signal was initially at ~5kft and gradually rose through altitudes of ~6kft, ~8 kft, ~13 kft, ~16 kft, and ~18 kft on successive profiles.

Overall summary. Despite the loss of the Terra spiral, this flight was highly successful. Flight above, within, and below a marine stratus deck should provide useful data on cloud impacts on chemistry and radiation. Sampling downstream of the DC-8 accomplished the quasi-lagrangian sampling objective, but the success of this objective is yet to be determined. Sampling of the pollution layer rising along the flight track from west to east provided an important verification of the model forecasts, all of which exhibited this feature to some degree. This data should also yield important information on differences in the photochemical evolution of Asian pollution depending on plume altitude.